proportion of L-arabinose in the total amount of the acid-hydrolyzed monosaccharides is 50% or more, and

subsequently the acid-hydrolyzed solution is separated into two sections including a section of L-arabinose-rich solution and a section of xylooligosaccharide or galactoorigosaccharide and insoluble residue, and L-arabinose contained in the vegetable fiber is selectively extracted.

C3 concld

**Marked Up Version Showing Changes**

1. (Three times Amended) A process for the manufacture of L-arabinose, characterized in that, vegetable fiber selected from the group consisting of envelopes of corn grains, axis of ear of corn, wheat bran, barley bran, oat bran, rye bran, rice bran, defatted rice bran, sugar beet fiber and apple fiber is contacted with an acid, wherein an acidic hydrolysis is carried out under such conditions [a condition] that

1) the concentration of acid is within the range of 0.01N to 0.5N,[ and]

2) the temperature is in the range of 80°C to 150°C, and

3) the total amount of the saccharides decomposed and eluted during the acidic hydrolysis is 30% or more on the basis of the dry substance to be hydrolyzed and the proportion of L-arabinose in the total amount of the acid-hydrolyzed monosaccharides is 50% or more, and

L-arabinose contained in the vegetable fiber is selectively produced.

8. (Four times Amended) The process according to Claim 1 further comprising [A process for the manufacture of a sugar alcohol solution containing L-arabitol, characterized in comprising] a step of hydrogenating the solution containing L-arabinose to produce a sugar alcohol containing L-arabitol. [obtained in the manufacturing process according to Claim 1.]

10. (Amended) A process for the manufacture of L-arabinose, characterized in that, vegetable fiber selected from the group consisting of envelopes of corn grains, axis of ear of corn, wheat bran, barley bran, oat bran, rye bran, rice bran, defatted rice bran, sugar beet fiber and apple fiber is contacted with an acid, an acidic hydrolysis is carried out under such a condition that

1) the concentration of acid is within the range of 0.01N to 0.5N, [and]

2) the temperature is in the range of 80° C to 150°C, [and]

3)the total amount of the saccharides decomposed and eluted during the acidic hydrolysis is 30% or more on the basis of the dry substance to be hydrolyzed and the proportion of L-arabinose in the total amount of the acid-hydrolyzed monosaccharides is 50% or more, and

subsequently the acid-hydrolyzed solution is separated into two sections including a section of L-arabinose-rich solution and a section of xylooligosaccharide or galactoorigosaccharide and insoluble residue, and L-arabinose contained in the vegetable fiber is selectively extracted.

Remarks

The Office Action mailed November 5, 2002, has been carefully considered. After such consideration, Claims 3, 5, 6, and 9 have been cancelled without prejudice. Claims 1, 2, 4, 7, 8 and 10 remain in the case, with none of the claims having yet been allowed.

The Office Action indicated that claims 1-6 were rejected under 35 USC 103(a) as being unpatentable over Schiweck, et al. U.S. Patent 4,816,078 (Schiweck), Weibel U.S. Patent 4,831,127 (Weibel-1), and Weibel U.S. Patent 5,008,254 (Weibel-2). In addition, the Examiner also rejected claims 1, 3, 5, 7, 9 and 10 under 35 USC 102(b) as being anticipated by Schiweck et al. U.S. Patent 4,816,078.

The starting materials in the present invention are vegetable fibers selected from the group consisting of envelopes of corn grains, axis of ear of corn, wheat bran, barley bran, oat bran, rye bran, rice bran, defatted rice bran, sugar beet fiber and apple fiber, while the starting materials in Schiweck are extracts from sugar beet pulp or other L-araban containing plant materials. Although the Examiner considered that the sugar beet fiber is equivalent to the sugar beet pulp, the sugar beet fiber is not equivalent to the extracts from sugar beet pulp.

The process for the manufacture of L-arabinose as claimed in claims 1 and 10 comprises contacting the starting material with acids under such conditions 1), 2), and 3) as mentioned above in claims 1 and 10. However, unlike Schiweck, the starting materials are not previously subjected to an extraction in alkali solution such as a $Ca(OH)_2$ solution to isolate hemicellulose such as arabinan and arabinoxylan from the starting materials.

Because the use of the above three conditions, 1) an acid concentration and 2) the temperature of the hydrolysis reaction as well as 3) the stage of completion of the acidic

hydrolysis, the commonly-used previous extraction of hemicellulose with an alkali is eliminated (see, page 5, line 19 to page 6, line 11).

The Office Action mentioned that Schiweck teaches a process for the production of crystalline L-arabinose from sugar beet fiber via acid hydrolysis at a temperature 92 to 97°C for 70 minutes wherein the sulfuric acid concentration is 0.5 to 2.0% (w/w)(column 2, lines 19-60). It is agreed that "Schiweck discloses hydrolysis under a mild condition (use of 0.01 to 0.5N acid solution)" as mentioned by the Examiner. However, Schiweck says an araban containing suspension requires, specifically, (a) dissolving the starting material at temperatures between 105°C and 160°C at an adjusting pressure obtained in a closed vessel for a reaction period of 2 to 20 minutes by the use of an aqueous calcium hydroxide solution, (b) neutralizing the resulting reaction solution with an acid and separating the undissolved plant material and the inorganic precipitate, (c) concentrating the aqueous phase by evaporation and separating an araban containing fraction and a by-product fraction, (d) hydrolyzing the araban containing fraction with a 0.5 to 2% by weight aqueous $H_2SO_4$ solution at a temperature 92°C to 97°C (see, Schiweck, claim 1). In Schiweck's steps (a) to (c), hemicellulose such as arabinan and arabinoxylan is extracted with an alkali from the starting materials so that L-arabinose in crystalline form can be obtained. But the reaction conditions for steps (a) to (c) are difficult to set up in order to carry out on an industrial scale.

And, Schiweck's yield is modest. The yield of the crystals (L-arabinose) obtained from 150kg beet pulp is 2.7kg with 95% purity (2.7/150 x 100=1.8%).

On the other hand, with the present invention, arabinose can be obtained with high purity, good efficiency and high yield and the secondary decomposition reaction hardly takes place. Specifically, the envelopes of corn grain are hydrolyzed in 0.15N sulfuric acid solution

under a temperature of boiling water for 1 hour. After neutralizing the solution with barium hydroxide, un-hydrolyzed corn grain and barium sulfate are removed from the solution containing useful saccharides by a centrifuge. When the solubilizing rate (total amount of L-arabinose, D-xylose and xylooligosaccharide) of 35.2% (=30% or more) and occupying rate of L-arabinose is 71% (=50% or more), the hydrolyzing rate of L-arabinose is 51% and D-xylose is 13% (see, Example 1, page 17, table 1). As a result, L-arabinose contained in the vegetable fiber can be selectively extracted in high purity, good efficiency and high yield.

Moreover, if the product after hydrolysis with 0.20N oxalic acid at 100°C for 1 hour was subsequently subjected to gel filtration using Bio-Gel by P2 (see, Example 3, page 18), it is easy to separate into two sections, including a section of L-arabinose-rich solution and a section of xylooligosaccharide or galactoorigosaccharide and insoluble residue (see Figure 1).

Weibel-1 (US 4,831,127) discloses that parenchymal cell- containing plant material, especially sugar beet and citrus pulp, can be hydrolyzed either in strong acid or in strong base, at high temperature for short periods of time together with mechanical shearing to yield cellulosic and the hemicellulosic biopolymers without excessive degradation (see, column 4, lines 54 to 59). And Weibel-2 (US 5,008,254) discloses that in the case of sugar beet pulp the extracted complex is composed of high molecular weight polysaccharides whose composition is largely L-arabinose, D-galactose and D-galacturonic acid. However, these references neither disclose nor suggest that the components such as L-arabinose, D-galactose and D-galacturonic acid can be decomposed from the polysaccharides in the sugar beet pulp, by a strong acid hydrolysis and how much the components thereof, L-arabinose, D-xylose and xylooligosaccharide can by hydrolyzed.

Therefore, the present invention would not have been obvious to one of ordinary skill in the art from Weibel-1 and Weibel-2 in combination with Schiweck. The process of obtaining L-arabinose in the present invention is distinguishable from the process indicated in Schiweck.

Claim 8 was rejected under 35 USC 102(b) as being anticipated by Gatzi, et al. Helv. Chim. Acta (1938), 21, 195-205 (English abstract). Claim 8 has been amended to clarify that it is dependent on claim 1 and therefore allowable.

The Applicant has placed the case in condition for immediate allowance and such action is respectfully requested. However, if any issue remains unresolved, Applicant's attorney would welcome the opportunity for a telephone interview to expedite allowance and issue.

Respectfully submitted,

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I HEREBY CERTIFY THAT THIS DOCUMENT IS BEING FACSIMILE TRANSMITTED TO THE PATENT AND TRADEMARK OFFICE (FAX NO. (703) 305-3014) TO: EXAMINER Patrick T. Lewis, ART UNIT 1623,
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